

Development of a Glycemic Index Checklist
for Individuals with Type 2 Diabetes

A Senior Honors Thesis

Presented in Partial Fulfillment for the Requirements
for graduation with distinction in Dietetics
in the College of Education and Human Ecology
at The Ohio State University

By
Catherine Rogers

The Ohio State University
June 2009

Project Advisors: Dr. Carla Miller, Associate Professor
Dr. Anne Smith, Associate Professor
Department of Human Nutrition

Literature Review

Health Benefits of a Low Glycemic Index Diet in People with Type 2 Diabetes

The glycemic index (GI) was created in 1981 by Dr. David J. Jenkins at the University of Toronto (Jenkins et al., 1981). Jenkins developed the glycemic index to measure and indicate glycemic response to foods containing carbohydrate. Understanding glycemic response to carbohydrate-containing foods is important for blood glucose regulation in people with type 2 diabetes. For people with type 2 diabetes to maintain their blood glucose within an acceptable range, it is essential to monitor both the quantity and quality of carbohydrates consumed (Salmer et al., 1997). Carbohydrate quality is an essential component because it incorporates many factors, including macronutrient composition, rate of digestion, methods of preparation and particle size, all of which have a significant impact on glycemic response. Rapidly digested carbohydrates carry high glycemic index values because their digested sugars quickly enter the blood stream, raising blood glucose. Rapidly digested carbohydrates are often low in fat and are highly processed and refined (small in particle size). In contrast, foods that are slowly digested have lower glycemic index values because their sugars and starches gradually enter the blood stream as they are slowly digested. Slowly digested carbohydrates are often higher in fiber, fat and contain complex starches. The complex nature of carbohydrate digestion and its impact on blood glucose makes it essential to consider carbohydrate quality along with quantity when monitoring blood glucose. While glycemic index reflects glycemic response regardless of quantity, glycemic load (GL) can be used along with glycemic index to factor in the quantity of carbohydrate consumed. Glycemic load is determined by multiplying the amount of carbohydrate by the glycemic index value for a food (Schulze et al., 2004). Glycemic index and glycemic load are therefore valuable measures to assist people with type 2 diabetes control their blood glucose and improve their overall health.

To demonstrate the health benefits associated with a low glycemic index diet in people with type 2 diabetes, a brief review of the literature will be provided. Rizkalla et. al (2004) conducted a study to examine the relationship between a low-glycemic index diet and improved plasma glucose control, whole-body glucose utilization and lipid profile (Rizkalla et al., 2004). The study used a sample of twelve individuals with type 2 diabetes who were randomly assigned to two periods of four week interventions on either a low-glycemic index diet or a high-glycemic index diet. Low-glycemic index carbohydrates were defined in the study as having a glycemic index value lower than 45 and high-glycemic index value foods were defined with a glycemic index value greater than 60. Following the two periods of intervention, the low-glycemic index diets significantly improved plasma glucose ($P<0.01$), glycosylated hemoglobin (HbA_{1c}) ($P<0.01$) and whole-body glucose utilization ($P<0.05$). The low-glycemic index diets also decreased fasting plasma total and LDL cholesterol ($P<0.01$), free fatty acids ($P<0.01$) and apolipoprotein B. The significant outcomes demonstrated in participants following the low-glycemic index diets were not observed in participants following the high-glycemic index diets.

Jimenez-Cruz et. al (2003) investigated the impact of a low-glycemic index on metabolic parameters and A_{1c} measures (Jimenez-Cruz, Bacardi-Gascon, Turnbull, Rosales-Garay, & Severino-Lugo, 2003). This randomized crossover study was conducted over two 6-week periods, during which participants were assigned to a high-glycemic index diet or a low-glycemic index diet during each period. Participants completed dietary intake diaries throughout each of the two 6-week periods to enable researchers to analyze potential relationships between dietary intake and lipid measures. The analyses demonstrated a significantly higher dietary fiber

intake during the low-glycemic index period ($P=0.003$) compared with the high-glycemic index diet period. Glycemic load and glycemic index were also identified as being significantly lower during the low-glycemic index period ($P=0.0001$). Along with the statistically significant dietary intake, glycemic index and glycemic load values associated with the low-glycemic index period, BMI, A_{1c} and fasting serum glucose all demonstrated decreased values during the low-GI period ($P=0.05$).

Brand et. al (1991) compared the efficacy of high- and low-glycemic index diets in the management of type 2 diabetes (Brand et al., 1991). The study was organized in a crossover design with two twelve week dietary periods. The sixteen participants were randomly assigned to either the high-glycemic index diet or the low-glycemic index diet. At the end of each dietary period, dietary intake was assessed for the sixteen participants using a 4-day weighed food record. At the conclusion of the two dietary periods, dietary food records from the participants in both the high- and low-glycemic diets were compared with records of biochemical assessments taken at baseline and at the end of each dietary period. The study demonstrated a significant improvement in glycemic control in the low-glycemic index diet compared to the high-glycemic index diet ($P<0.05$). The low-glycemic index diet participants further demonstrated mean glycosylated hemoglobin levels 11% lower than participants on the high-glycemic index diet. An average glycemic intake 15% lower in participants on the low-glycemic index diet than those on the high-glycemic index diet was also demonstrated from the analyses. Based on the findings of this study, researchers were able to conclude that a low-glycemic index diet improves long-term glycemic control in individuals with type 2 diabetes.

Schulze et. al (2004) investigated the incidence of type 2 diabetes in women and the influence of glycemic index, glycemic load and dietary fiber (Schulze et al., 2004). The study required completion of a semiquantitative food-frequency questionnaire that measured overall dietary intake. The semiquantitative food-frequency questionnaires were completed by 91,249 women. The participants were monitored for eight years to identify incidences of type 2 diabetes and potential relationships with dietary intake. Following the eight year study, 741 cases of type 2 diabetes were identified from the original 91,249 participants. Dietary intakes were analyzed for all participants, including those that were not diagnosed with type 2 diabetes during the eight year study. The analyses demonstrated that a higher glycemic diet was strongly associated with a higher incidence of type 2 diabetes ($P<0.001$). A greater risk for the development of type 2 diabetes was also associated with low dietary intakes of cereal and fruit fiber. Based on the findings of the study, researchers were able to demonstrate that a high-glycemic diet produces higher blood glucose concentrations and greater insulin production than low-glycemic index diets. Based on this finding, the study concluded that the elevated blood glucose concentrations and increased insulin production associated with high-glycemic index diets may advance pancreatic exhaustion and insulin resistance, ultimately leading to type 2 diabetes.

Salmeron et. al (1997) conducted a research study to investigate the relationship between dietary fiber, glycemic load and the development of type 2 diabetes in women. The six year study involved 65,173 women between the ages of 40 and 65. Participants completed dietary questionnaires throughout the duration of the study to track dietary glycemic index, glycemic load and total and specific sources of dietary fiber. At the completion of six year study, 915 cases of diabetes were documented. Researchers used the dietary questionnaires to identify important trends between dietary intake, glycemic load and incidences of diabetes among participants. Dietary glycemic index (P trend= .005) and glycemic load (P trend=.003) were positively correlated with diabetes. Total fiber intake and specific fiber sources were

analyzed using the dietary questionnaires completed by participants. The analyses demonstrated cereal fiber intake to be inversely correlated with the development of diabetes (P trend=.001). The study also determined that the combination of a high-glycemic load and low cereal fiber intake was associated with an increased risk for the development of type 2 diabetes. This study demonstrated the importance of a low glycemic index diet in the prevention of type 2 diabetes.

A similar study conducted by Salmeron et. al (1997) investigated the relationship between dietary fiber, glycemic load and the development of type 2 diabetes in men (Salmer et al., 1997). Following the 6 year intervention, 523 participants of the original 42,759 participants developed type 2 diabetes. Every two years participants were provided with a validated semiquantitative food-frequency questionnaire containing 131 food items to assess diet intake. A positive correlation was identified between dietary glycemic index and type 2 diabetes (P trend=0.03). Although total dietary fiber returned no significant association with reduction in type 2 diabetes, cereal fiber resulted in a significant inverse relationship with development type 2 diabetes (P trend=0.007). This study continued to demonstrate the importance of incorporating low glycemic index foods into one's diet to prevent and delay the onset of type 2 diabetes.

Frost et. al (1994) investigated the affect of glycemic index dietary education on individuals' dietary profile and management of type 2 diabetes (Frost, Wilding, & Beecham, 1994). Fifty-one newly diagnosed individuals with type 2 diabetes participating in this 18 month study were randomly assigned to either a standard advice group or a low glycemic index advice group. Both groups were advised to consume 50% of energy from carbohydrate, emphasizing non-starch polysaccharides (dietary fiber) and 35% of energy from fat. The low-glycemic index advice group received additional dietary education on the glycemic index from verbal and written resources. Dietary intake was gathered for both subsets using two 3-day diet diaries. Upon completion of the study, progress was measured by comparing baseline values and post-intervention values for: the two 3-day diet diaries, fasting blood glucose levels, fructosamine levels, total cholesterol and triacylglycerols levels. According to the dietary analyses, the low glycemic index advice group reported a significantly lower mean glycemic index intake ($p<0.01$). The study further demonstrated a significant relationship between the glycemic index of the diet and a reduction in fructosamine. The researchers of the study concluded based on their findings that participants given advice and education regarding the glycemic index and its importance in management of type 2 diabetes consumed diets lower in dietary glycemic intake than those who did not receive advice and education.

These studies, along with many others, have demonstrated the beneficial impact of a low glycemic index diet in the management and control of type 2 diabetes. These studies have shown that consuming low glycemic index foods helps improve plasma glucose, HbA_{1c} and lipid levels. Diets low in glycemic index have also been associated with improved whole-body glucose utilization and decreased insulin production in individuals with type 2 diabetes. The many benefits associated with consuming a diet low in glycemic index will enable individuals with type 2 diabetes to not only help them manage and control their diabetes, but will also enable them to improve their overall health.

Cognitive Interviewing to Improve Dietary Assessment Instruments

In order to obtain accurate, valid and reliable data from participants, it is essential to guarantee that the dietary measurement tools selected to gather data are proficient (Alaimo 1999). Cognitive interviewing is one method used to gather insight about the way dietary

measurement tools are analyzed and interpreted. Cognitive interviews are therefore often used in research to modify and improve dietary questionnaires (Willis 1999). Modifications made following cognitive interviews allows researchers to not only improve the validity and reliability of dietary questionnaires, but enables them to make questionnaires effective methods for communication (Carbone, Campbell, & Honess-Morreale, 2002). Effective methods of communication are important when gathering data because it ensures that the data obtained is both accurate and valid. Effective methods of communication are able to gather accurate and valid data because they are personally relevant to participants, conform to participants' understanding and view of the world and are customized to both the needs and interests of participants. Therefore in order to develop dietary measurement tools that are accurate, reliable and effective in communication, cognitive interviews are used to gather incite about the cognitive processes participants use to interpret and complete dietary questionnaires.

Cognitive interviews assess dietary measurement tools for areas of misinterpretation and misunderstanding. Areas such as question comprehension, retrieval from memory of relevant information, the decision process and the result process are areas that often are focused on during cognitive interviews (Willis 1999). The information gathered from participants during the cognitive interviewing process enables modifications to be made to the structure, wording and organization of questions so they are interpreted and understood as intended. Cognitive interviews therefore are critical for improving and modifying dietary measurement tools as they allow researchers to exercise a degree of control when gathering data.

In order to gather the desired information from participants using the cognitive interview process, two methods may be employed: think-aloud interviewing or probing interviewing. Using think-aloud interviewing, the researcher asks the participant a question and then instructs them to discuss their thoughts aloud and explain how they arrived at their decision (Willis 1999). Participants are encouraged to express any confusion or misunderstandings they may encounter when completing the dietary assessment tool. Unlike think-aloud interviewing which encourages participants to talk through their cognitive processes following each question, probe interviewing allows a participant to complete the entire questionnaire and then follows with a "probing" session conducted by the researcher. When using probe interviewing to conduct a cognitive interview, researchers must decide between two methods of probing, concurrent probing or retrospective probing. With concurrent probing, the researcher asks the participant a question and upon receiving a response from the participant, the interviewer immediately follows with a probing question to more thoroughly understand why the participant chose their response. Retrospective probing differs because rather than probing after each question, the researcher conducts the entire interview and then follows with the probing questions.

Research studies frequently use the cognitive interviewing process to assess the quality of a questionnaire. A study conducted by Carbone et. al (2002) used cognitive interviews to assess the FoodSmart survey questions and tailored messages (Carbone et al., 2002). A convenience sample of 23 participants displayed four reoccurring issues that weakened the effectiveness of the FoodSmart survey. The cognitive interviews demonstrated that the FoodSmart survey contained vague and ineffective instructions, vague questions and response options, inconsistent interpretation of terms and misinterpretation of dietary recommendations. Cognitive interviewing proved to be extremely beneficial for the FoodSmart survey by highlighting many weaknesses that may have altered the validity of the survey. Based on the results from the cognitive interviews, words and concepts were clarified and vague instructions were more clearly defined.

A study conducted by Wolfe et. al (2001) used cognitive interviews to test three dietary measurement tools developed to assess fruit and vegetable consumption (Wolfe, Frongillo, & Cassano, 2001). After cognitive interviewing had been conducted with a sample of 31 adults, the researchers analyzed the findings and found several areas of concern: time frame, wording of phrases, interpretation issues with terms used, and serving size options. Based on the incite received, corrections were made to revise and improve the three fruit and vegetable assessment tools. Researchers in the study established an explicit time frame in which the assessment tools were to be completed, clarified unclear wording and more clearly defined the serving sizes provided on the tools to improve the quality and validity of the three dietary assessment tools.

Alaimo et. al (1999) used the cognitive interviewing process on multiple food insufficiency, hunger and food insecurity questionnaires to evaluate interpretation of the various dietary assessment tools (Alaimo 1999). The goal of the study was to determine how different questions were understood by participants and if the many questions measured what they were intended to measure. Researchers conducting the cognitive interviews focused on identifying common themes and discrepancies that consistently appeared in participants' responses. The cognitive interviews revealed that several phrases and wording selections used in numerous questions caused confusion and misinterpretation. After analyzing the data gathered from the interviews, the researchers concluded that several words and phrases used in the questionnaires could easily be interpreted multiple ways. For example, one question stated: "*My children are not eating enough because I just can't afford enough food*" [Response: never true, sometimes true, often true]. A separate question was asked using different wording but intended to measure the same construct, whether respondents' children received an inadequate intake of food regularly. The second question asked: "*Were your children ever hungry because you just couldn't afford more food?*" [Response: yes or no]. Although most respondents interpreted both questions as inquiring about a lack of food in a child's diet, some respondents interpreted "*eating enough*" in the first question as both a qualitative and quantitative concept. However in the second question the term "*hungry*" was never interpreted as indicating the quality of one's diet. Along with unclear wording of questions, the cognitive interviews also demonstrated that the response categories provided in numerous questions were vague and often did not provide an appropriate response for participants. The cognitive interviewing process allowed the food insufficiency, hunger and food insecurity questionnaires to be modified so that they would provide accurate and valid responses to more accurately serve as a dietary assessment tool.

Validation of Dietary Assessment Instruments

While cognitive interviews are useful to gain an understanding of the interpretation and comprehension of dietary assessment tools, it is essential for these tools to be validated as well. In order for research to be acknowledge and supported, it is essential to use validated tools (Block & Hartman, 1989). In order for a tool to be valid, it must accurately measures what it is intended to measure. To determine the validity of a dietary assessment tool such as a food behavior checklist, the data gathered from the food behavior checklist must be correlated with a different tool that uses a different method to ideally gather the same data. In order to prove the validity of the original measure, significant correlations must exist between the two data sets.

Block et. al (2000) aimed to validate a food screener developed to assess fruit, vegetable and fat intake (Block, Gillespie, Rosenbaum, & Jenson, 2000). In order to validate the food screener, the previously validated 1995 Block 100-food item food frequency questionnaire (FFQ) was used. Two hundred male and female participants self-administered the food screener and

the Block FFQ. Correlations were carried out to compare reported macronutrient and micronutrient gathered from the two dietary assessment tools. Predictive values were also determined by comparing reported intake from the food screener with those obtained from the Block 1995 FFQ. The food screener was determined to be a valid dietary assessment tool as it was able to identify individuals with a high-fat or a low-fruit and vegetable intake. Correlations for total fat, saturated fat, cholesterol and fruit and vegetable intake were between 0.6 and 0.7 ($p < .0001$). The statistical correlations between the two dietary assessment tools further demonstrated the food screener's ability to properly identify individuals with high percentages of calories from fat, total fat, saturated fat or cholesterol along with individuals with low intakes of potassium, fiber or vitamin C. The study's use of a previously validated dietary assessment tool to validate the newly developed food screener successfully showed the food screener's ability to accurately assess nutrient intake and demonstrated its validity as a dietary assessment tool.

Food frequency questionnaires are dietary assessment tools that are often used to determine individuals' food consumption and nutrient intake. However before FFQs can be used to assess dietary intake, these tools must be properly validated to demonstrate that they are accurate and reliable instruments. A study by Mullen et. al (1984) focused on validating a food frequency questionnaire designed to assess daily food intake (Mullen, Krantzler, Grivetti, Schutz, & Meiselman, 1984). Nutrient profiles gathered from the FFQ were compared with nutrient profiles gathered from a self-report assessment form that was completed following every meal. Regression equations and correlation coefficients were calculated using the data gathered from the food frequency questionnaire and the self-report forms. Correlation coefficients ranged from 0.23 to 0.91 with 85% of the values $> .50$ and 55% $> .71$. All of the correlations conducted were significant ($p < 0.002$), demonstrating that the FFQ tested in this study was a valid dietary assessment tool.

Kristal et. al investigated the development and validation of a Food Behavior Checklist (FBC) for evaluating food intake (Kristal et al., 1990). The Food Behavior Checklist (FBC) was designed to measure intake of low-fat and high-fiber foods. To validate the FBC the study compared responses from participants on the FBC with a 24-hour diet recall, examining the proportion of individuals with the same responses from the FBC and the 24-hour recall. Kappa statistic was used to measure agreement between the two dietary assessment tools. Intake on the Food Behavior Checklist and the 24-hour recall reported similar responses when compared. Correlations were conducted to compare responses for 18 foods found on both the FBC and the 24-hour recall. Observed agreement was under 85% for only three food items (high-fiber cereal, whole-grain breads & butter/margarine on bread) and only two kappas (high-fiber cereal & bacon or sausage) were under 0.60. Agreement between the two measures was very good and excellent for 11 of the 18 items ($\text{kappa} > 0.80$) and was determined as good for 5 of the items ($\text{kappa} > 0.60$). The use of a 24-hour recall to validate the FBC demonstrated the tool's ability to accurately assess dietary intake.

Newby et. al aimed to determine the reproducibility and validity of the Diet Quality Index Revised (DQI-R) (Newby et al., 2003). Two food-frequency questionnaires and two dietary recalls were used to assess and compare reported nutrient intake from the different dietary assessment tools. Participants completed the two FFQs at one year intervals, along with two one-week diet records. A possible score of 100 was used to compare each of the FFQs and diet records with the DQI-R. Out of the possible score of 100, the mean DQI-R score was 69.5 when compared with FFQ-1, 67.2 with FFQ-2 and 62.0 for the diet records. The reproducibility correlation between FFQ-1 and the diet records was 0.66 and 0.72 for FFQ-2. Diet records were

one of the tools used in this study to validate the DQI-R because they are the most commonly used dietary assessment tool used to validate FFQs. The study's use of data obtained from both the dietary records and the FFQs strengthened the validation of the DQI-R.

To accurately measure fruit and vegetable intake, Murphy et. al (2001) conducted a study to assess the validity of a food-behavior checklist designed to measure fruit and vegetable intake (Murphy, Kaiser, Townsend, & Allen, 2001). Participants completed the 39 item food-behavior checklist and 3 one-day dietary recalls. A three pass method was used with the dietary recalls to validate the food-behavior checklist. The three pass validation process began with participants listing all foods consumed on a specified day. The second pass then required participants to provide details about the foods they listed in step 1. After providing descriptive details about foods consumed, the third pass then asked participants to review what they had reported to identify possible errors or omissions from the first two steps. Spearman correlation coefficients were then calculated between responses from the food-behavior checklist and the mean nutrient intakes from the 24-hour recalls. Twelve items were significantly correlated between the food-behavior checklist and the 24-hour recalls, demonstrating a degree of convergent validity between the two dietary assessment tools. The study concluded that dietary recalls often underestimate total energy and nutrient intakes. However despite these underestimates of intake, dietary recalls remain the primary method for obtaining nutrient intake. Since dietary recalls are validated tools used to assess dietary intake, Murphy et. al incorporated the 12 significantly correlated items into the food-behavior checklist.

A study carried out by Drewnowski & Hann investigated the validity of food frequency questionnaires reporting nutrient intake and the impact food preferences have on reported dietary intake (Drewnowski & Hann, 1999). Eighty-seven participants completed a 98-item food-frequency questionnaire that included a rating section. The rating section required participants to rate specific foods on a 9-point scale to indicate food preference. The frequencies indicated on the FFQ were used to classify foods into specific categories; foods consumed ≥ 3 times a week were considered core foods and foods consumed at least weekly were subsidiary core foods. The analyses demonstrated that the majority of items testing both frequency and preference of intake were significantly correlated. The study further demonstrated that because FFQs require individuals to use both memory and cognitive processes, it is essential to incorporate these factors into the design of the FFQ. Since food frequency reports are an approximation of ones daily food intake and are based on ones' perceived view of their diet, reports tend to be greatly influenced by individuals' likes and dislikes. When individuals are unable to precisely recall their consumption, food preferences are often chosen regardless if they were actually consumed. The extent to which food preferences influence the outcome on food frequency questionnaires varies with the participant. Typically food preferences have the greatest influence in children and adolescents, but have an impact on most individuals. Therefore, it is essential to consider the influence of food preferences when developing or using food frequency questionnaires.

In summary, previous studies have demonstrated that following a low glycemic index diet will help individuals with diabetes gain better control and management of their blood glucose and overall health. Along with explaining the benefits of following a low glycemic index diet, previous studies have also demonstrated the benefits of using cognitive interviews to assess and modify dietary assessment tools. Once modifications have been made to ensure appropriate interpretation and comprehension of dietary assessment tools, it is critical to validate the tool to guarantee that accurate and reliable data is generated from the implementation of the dietary assessment tool.

Introduction

While recent studies have been conducted demonstrating the beneficial outcomes of low glycemic index foods on individuals' health, a tool to assess the number of low glycemic index foods consumed by an individual has not been previously designed for use in public health settings. In order for public health recommendations on low glycemic index foods to be implemented successfully, studies must demonstrate effective methods for promoting dietary behavioral change. Once these methods have been used to educate patients, it is essential to have adequate tools to measure the impact of the dietary behavioral change. Food frequency questionnaires are often used in epidemiological studies; however this tool usually contains over 100 items, may require up to one hour to complete and demands a high level of literacy. New tools are needed to obtain valuable knowledge regarding one's intake of low glycemic index foods through dietary assessment.

Dr. Carla Miller at The Ohio State University developed a glycemic index food behavior checklist to assess the number of low glycemic index foods consumed by individuals on a daily basis (see Appendix A). Two studies were conducted to modify and validate this low glycemic index food behavior checklist. First cognitive interviews were conducted to modify the GI checklist using the insight obtained from the interviews. Following the modification of the original checklist, the revised checklist was validated using the Block 2005 Food Frequency Questionnaire (FFQ).

Subjects: The population of interest in both subsets of the study were adults (males and females) between the ages of 40 and 70 who had been diagnosed with type 2 diabetes for at least one year.

Setting: The study was conducted at The Ohio State University. Participants were recruited at The Ohio State Medical Center's Diabetes Research Center, at The Columbus Ohio Diabetes Association, The Ohio State Medical Center, the Greater Cleveland Diabetes Association, the Ohio Diabetes Association and South Pointe Hospital in Cleveland, Ohio.

Study #1: Modification of the Glycemic Index Checklist

Methods

Ten cognitive interviews were conducted for the modification subset of the study to assess the interpretation and comprehension of the original GI checklist. Using the information obtained from the interviews, the original checklist was modified to better ensure that the GI checklist was interpreted as intended. To obtain an appropriate sample (n=10), many resources and methods were used to recruit interested and eligible participants. Recruitment flyers with participant eligibility requirements and contact information were displayed and distributed to recruit potential participants. Flyers were posted at The Ohio State Medical Center's Diabetes Research Center, at various public locations on The Ohio State University campus and at numerous coffee shops and libraries in Columbus, Ohio. Additional participants were recruited at senior centers in Columbus, Ohio and South Euclid, Ohio. Along with flyers, contact information of potential participants was obtained from previous research studies in people with type 2 diabetes who provided permission to be contacted for additional studies.

The cognitive interviews used in this study were retrospective and used verbal probing to obtain essential information from participants. Each cognitive interview session was audio recorded so responses could be reviewed and analyzed more thoroughly at a later time. The cognitive interviews began with the researcher informing the participant that the purpose of the interview was not to analyze their diet based on the assessment tool they would be completing. The researcher explained that what was of interest was the way in which the participant interpreted the assessment tool and used it to reflect their dietary intake. Following this explanation the researcher provided the participant with the glycemic index checklist and instructed the participant to complete the checklist based on the previous day's food consumption. The researcher explained to the participant that they should take their time completing the checklist, as they would receive as much time as needed to complete the GI checklist. The researcher asked the participant to simply open the door to the laboratory when they completed the checklist. The researcher left the room and began timing the amount of time needed to complete the checklist. Once the participant opened the door to indicate they were finished, the researcher stopped the timer, recorded the time and then returned to the room with the participant.

Before beginning the cognitive interview session the researcher asked the participant for permission to audio record the session so that the interview could be reviewed later in the study. The researcher informed the participant that upon completion of the study, the recording would be destroyed. Upon receiving permission, the researcher began the tape recorder and the interview. The researcher first reminded the participant that the purpose of the interview was not to analyze their diet but to gather information about the way they interpreted and completed the checklist. The researcher then explained to the participant that they would begin with an exercise to demonstrate the way the interview would be conducted. The researcher asked the participant to first visualize their place of residency. The researcher asked the participant to think of the windows in their place of residence and count the number of windows. The researcher asked the participant to talk through the process of determining the final total number of windows in their place of residence. Upon completion of the exercise, the researcher informed the participant that this approach would be used throughout the interview; the participant would talk through the decisions they made when completing the checklist to accurately portray their dietary intake. The researcher used specific, predetermined questions to gain a thorough understanding of how the participant interpreted and used the checklist to indicate their dietary intake (see Appendix). Each preset question was followed by a series of probing questions to help the researcher obtain a thorough understanding of the individuals' interpretation of the checklist based on the participant's original response. After completing the cognitive interview session, participants received \$20 for their time and participation. Upon completion of the ten individual cognitive interviews, the information gathered from the participants was reviewed to identify trends and patterns among participant responses. The checklist was then modified based on the feedback gathered from the cognitive interviews to make it a more effective tool for measuring dietary intake of low glycemic index foods.

Results

Ten cognitive interviews were conducted at The Ohio State University. The interviews consisted of eight questions, with each question being followed by additional probing questions (Appendix C). The interviews demonstrated a consistent problem with the serving size

descriptions. Seven of the ten participants expressed confusion with the multiple serving sizes provided (cup, ounce, count). Of the seven participants that struggled with the provided serving sizes, all stated that when a count value was provided, it was the preferred method to use to estimate intake. For example, these seven participants preferred to use the serving size of 8 baby carrots rather than ½ cup of carrots to report their intake.

Of the ten participants, three participants found it very difficult to use the serving size boxes to indicate their intake. Four participants thought it was very easy to use the serving size boxes to complete the checklist. Three participants explained that they initially were unclear about using the serving size boxes; but after reading the instructions, they indicated they were able to use the serving size boxes to complete the checklist.

The cognitive interviews demonstrated the absence of frequently consumed low glycemic index foods from the checklist. During the interviews three participants reported consuming salad; however all three participants chose not to select lettuce on the checklist. One participant reported during an interview the absence of turnip greens on the checklist. Three of the ten participants reported during the interviews that frozen meals are often part of their diet. All three participants indicated that they were unsure how to apply the contents of frozen meals to the checklist.

Table 1. Study #1: Demographic Characteristics of the Sample

	N	Mean or %
Age (mean years)	10	66.33 (\pm 10.12)
Sex		
• Female	5	50%
• Male	5	50%
Ethnicity		
• Caucasian	8	80%
• Black	2	20%
HbA_{1c} value	6	7.53%
Body Mass Index (kg/m ²)	10	35.13 (\pm 6.29)

Discussion

The cognitive interviews demonstrated several modifications to improve comprehension of the original glycemic index checklist to make it a more reliable and applicable tool. The multiple serving sizes provided for each food caused confusion and therefore modification was essential. When both measuring cup and count values were provided, the measuring cup values were removed because the cognitive interviews consistently demonstrated that the count values were the preferred serving reference. However both the count value and the measuring cup value remained for two foods on the checklist (carrots and corn). It was essential to leave both the count value and the measuring cup value for carrots and corn on the checklist because they provide for differences in cooking preparation. The count value for carrots (8 baby carrots) is in the raw form, while the measuring cup value (1/2 cup) is following cooking. Cooking alters food composition, making it essential to provide both serving size references to accurately determine individuals' dietary intake. For corn it is also imperative to provide a count value (1 ear) and a measuring cup value (1/2 cup cooked) to account for different serving styles.

No modifications were made to the serving size box format due to the diverse outcomes obtained from the interviews. Although three participants found it very difficult to use the serving size boxes, four participants stated that the format was very clear and could easily be used to indicate food intake. More importantly, the three participants that were initially confused reported that after reading the instructions provided on the checklist, they were able to use the serving size boxes without difficulty. Based on these results, no modifications were made to the serving size box format used on the original checklist.

Additional low glycemic index foods were added to the checklist to improve its ability to represent low glycemic index food consumption. Salad was added to the vegetable group of the checklist as a separate option from lettuce. Turnip greens were also added to the vegetable group of the checklist to provide ethnic and cultural diversity.

Study #2: Validation of the Glycemic Index Checklist

Methods

In order for the glycemic index behavior checklist to be used by individuals with type 2 diabetes to assess, educate and monitor GI consumption, the tool must be validated to better ensure that the assessment tool accurately measures dietary intake. To validate the checklist the Block 2005 Food Frequency Questionnaire (FFQ) was used. The Block 2005 Food Frequency Questionnaire is a validated dietary assessment tool designed to estimate intake of an array of nutrients and food groups (Block, Hartman, & Naughton, 1990). The questionnaire's 110 food item list was developed from NHANES 1999-2002 dietary recall data. The nutrient database used to analyze the Block 2005 FFQ was developed from the USDA Food and Nutrient Database for Dietary Studies (FNDDS). The validated Block 2005 questionnaire was used to validate the low glycemic index checklist to determine if similar nutrient intakes are obtained from both tools.

The same participation criterion was used in the second study as in the first study, with participants being between the ages of 40 and 70 and having type 2 diabetes for at least one year. Several participants were recruited at an American Diabetes Association event (Dining with Diabetes). Contact information of additional potential participants was obtained from previous research in people with type 2 diabetes. Participants were screened either in person or over the phone to determine eligibility status. If eligible, participants were sent a participant packet that included: an instruction sheet, a demographic questionnaire, two consent forms, the low glycemic index checklist and the Block 2005 FFQ. The instructions informed participants to sign and return one consent form and complete and return the demographic questionnaire, the low glycemic index checklist and the 2005 Block FFQ. Once the questionnaires were received at the lab, participants were sent \$10 for their time and participation.

Data gathered from the demographic questionnaires and low glycemic index checklists were coded and entered into a Microsoft Office Excel 2007 database. The Block 2005 FFQs were sent to be analyzed for participant nutrient intake values by NutritionQuest (Berkeley, California). Totals were calculated for each participant using their completed glycemic index checklist for servings from fruit, vegetable, dairy, grain and snack foods. Along with the individual food group totals, total daily consumption of low glycemic index foods was calculated. The completed checklists were then entered into NDSR (Nutrient Data Systems for

Research) to analyze participants' diets for individual nutrients and daily glycemic index and glycemic load values. After obtaining nutrient profiles from the low glycemic index checklist using NDSR and nutrient profiles from the Block 2005 FFQ, correlations were run to compare the nutrient profiles obtained from the two dietary tools. The nutrients selected for the correlations were nutrients that were well represented on the glycemic index checklist and included: total carbohydrate, total fiber, vitamin C, calcium and folate. Glycemic index and glycemic load could not be correlated using the nutrient profiles generated from the two dietary assessment tools because the nutrient databases used to analyze the two tools used different glycemic index reference values.

Along with the correlations comparing nutrient profiles generated from the two dietary assessment tools, sensitivity and specificity were calculated. The intent of the GI checklist is to identify individuals with inadequate low GI consumption. To determine if the GI checklist was able to accurately identify individuals with inadequate low GI consumption, sensitivity was used. Sensitivity is a statistical measure used to determine if assessment tools are able to identify individuals at-risk for disease. At-risk for disease were patients consuming an inadequate intake of low GI foods because of the many health benefits associated with a high dietary intake of low GI foods. Along with identifying individuals at-risk for disease, specificity was determined to identify individuals not at-risk for disease. Individuals not at-risk for disease were those identified as consuming a high intake of low GI foods. To obtain the most accurate results, the 33 participants were divided into two subsets according to their daily caloric intake based on the Block 2005 FFQ nutrient profiles. The low energy subset included participants consuming <1800 kilocalories and the high energy subset included participants consuming ≥ 1800 kilocalories. To determine recommended daily intake for fruits, vegetables, dairy and grains, a 1600 kilocalorie diet was used to calculate recommended intake for the low energy subset and a 2000 kilocalorie diet was used to calculate recommended intake for the high energy subset. Recommended intake for servings of fruits, vegetables, dairy and grains for each subset was then determined using the 2005 Dietary Guidelines for Americans. Once the recommended intakes were established, fruit, vegetable, dairy and grain servings were gathered for each participant from the Block 2005 FFQ profiles. The Block 2005 FFQ servings were used to categorize participants as either consuming an adequate (high) or inadequate (low) intake of fruits, vegetables, dairy and grains. The Block 2005 FFQ categorizations were then used to determine if the GI checklist was able to similarly categorize participants as either low or high consumers.

Adequate (high) and inadequate (low) intake for the GI checklist was determined by calculating the median number of fruit, vegetable, dairy and grain servings consumed by participants in each subset. Once cut-points were established for high and low intake of fruits, vegetables, dairy and grains, participants were categorized based on the number of servings indicated on the GI checklist. Sensitivity and specificity were calculated using the categorizations based on the Block 2005 FFQ nutrient profiles and the 2005 Dietary Guidelines for Americans and the categorizations based on the GI checklist. Sensitivity specified the number of individuals that were identified as consuming a low intake on both the Block 2005 FFQ and the GI checklist, demonstrating that the GI checklist was able to accurately identify individuals with an inadequate intake. Specificity demonstrated the number of individuals identified as having a high intake on both dietary assessment tools, demonstrating the ability of the GI checklist to accurately identify individuals with a high intake of low GI foods.

Results

Participant Characteristics:

49 eligible participants agreed to participate in the validation study and were mailed questionnaire packets to complete. Of the original 49 participants, 33 participants (67%) completed and returned their questionnaire packet. Seventy percent of the participants were female (n=23) and 30% (n=10) were male. The mean (\pm SD) age of the 33 participants was 59.2 (\pm 7.5) years old. Eighty-eight percent of the participants were Caucasian, 9% were Black or African-American and 1% Hispanic or Latino American. The mean (\pm SD) body mass index (BMI) of the 33 participants was 32.7 kg/m² (\pm 8.0). Of the 24 participants to report a HbA_{1c} value, the mean was 6.8%.

Table 2. Study #2: Demographic Characteristics of the Sample

	N	Mean or %
Age (mean years)	33	59.2 (\pm 7.5)
Sex		
• Female	23	70%
• Male	10	30%
Ethnicity		
• Caucasian	29	88%
• Black	3	9%
• Hispanic	1	3%
HbA _{1c} value	24	6.8%
Body Mass Index (kg/m ²)	33	32.7 (\pm 8.0)

Correlations between the Glycemic Index Checklist Nutrient Profiles and the Block 2005 FFQ Nutrient Profiles:

One hundred percent (n=6) of the nutrients correlated between the nutrient profiles generated from the glycemic index checklist using NDSR and the Block 2005 FFQ were statistically significant (p<.05). Highly correlated nutrients included: total carbohydrate, total fiber, vitamin C, calcium, folate and magnesium.

Table 3. Correlations between the GI Checklist Nutrient Profiles and the Block 2005 FFQ Nutrient Profiles

Nutrient	Pearson <i>r</i> Value	Significance (<i>p</i> Value)
Total Carbohydrate	0.41	.019
Total Fiber	0.56	.001
Vitamin C	0.42	.015
Calcium	0.39	.026
Folate	0.38	.048
Magnesium	0.58	<.001

Sensitivity and Specificity for the GI Checklist total low GI intake and the Block 2005 FFQ total intake:

Table 4. Sensitivity and specificity for GI Checklist key food groups for low energy (<1800 kcals) consumers

Food Group	Sensitivity (%)	Specificity (%)
Fruit	60.00	33.33
Vegetable	33.33	0.00
Dairy	47.06	0.00
Grains	47.06	0.00

Table 5. Sensitivity and specificity for GI Checklist key food groups for high energy (\geq 1800 kcals) consumers

Food Group	Sensitivity (%)	Specificity (%)
Fruit	80.00	75.00
Vegetable	50.00	0.00
Dairy	36.36	33.33
Grains	50.00	50.00

Table 6. GI checklist intake based on median intake and Block 2005 FFQ intake based on 2005 Dietary Guidelines for Americans for a 1600 kcal diet

GI Checklist	2005 Dietary Guidelines for Americans (1600 kcal)		
Fruit^a	Less than 1.5 cups	1.5 cups or more	Total
Low (<2.0 cups)	9	2	11
High (≥2.0 cups)	6	1	7
Total	15	3	18
Vegetable^b	Less than 2 cups	2 cups or more	Total
Low (<2.0 cups)	6	0	6
High (≥2.0 cups)	12	0	12
Total	18	0	18
Dairy^c	Less than 3 cups	3 cups or more	Total
Low (<3.5 cups)	8	1	9
High (≥3.5 cups)	9	0	9
Total	17	1	18
Grains^d	Less than 5 ounces	5 ounces or more	Total
Low (<2.5 ounces)	8	1	9
High (>2.5 ounces)	9	0	9
Total	17	1	18

^a: Sensitivity (ability to identify low intake) 9/15= 60.00%

Specificity (ability to identify high intake) 1/3= 33.33%

^b: Sensitivity (ability to identify low intake) 6/18= 33.33%

Specificity (ability to identify high intake) 0/0= 0.00%

^c: Sensitivity (ability to identify low intake) 8/17= 47.06%

Specificity (ability to identify high intake) 0/1= 0.00%

^d: Sensitivity (ability to identify low intake) 8/17= 47.06%

Specificity (ability to identify high intake) 0/1= 0.00%

Table 7. GI checklist intake based on median intake and Block 2005 FFQ intake based on 2005 Dietary Guidelines for Americans for a 2000 kcal diet

GI Checklist	2005 Dietary Guidelines for Americans (2000 kcal)		
Fruit^a	Less than 2 cups	2 cups or more	Total
Low (<2.0 cups)	8	1	9
High (≥2.0 cups)	2	3	5
Total	10	4	14
Vegetable^b	Less than 2.5 cups	2.5 cups or more	Total
Low (<1.5 cups)	7	0	7
High (≥1.5 cups)	7	0	7
Total	14	0	14
Dairy^c	Less than 3 cups	3 cups or more	Total
Low (<3.0 cups)	4	2	6
High (≥3.0 cups)	7	1	8
Total	11	3	14
Grains^d	Less than 6 ounces	6 ounces or more	Total
Low (<2.0 ounces)	3	4	7
High (>2.0 ounces)	3	4	7
Total	6	8	14

^a: Sensitivity (ability to identify low intake) 8/10= 80.00%

Specificity (ability to identify high intake) 3/4= 75.00%

^b: Sensitivity (ability to identify low intake) 7/14= 50.00%

Specificity (ability to identify high intake) 0/0= 0.00%

^c: Sensitivity (ability to identify low intake) 4/11= 36.36%

Specificity (ability to identify high intake) 1/3= 33.33%

^d: Sensitivity (ability to identify low intake) 3/6= 50.00%

Specificity (ability to identify high intake) 4/8= 50.00%

Discussion

The Glycemic Index checklist was developed to be used as a dietary assessment tool to evaluate daily consumption of low glycemic index foods by individuals with type 2 diabetes. Assessing consumption of low glycemic index foods by individuals with type 2 diabetes is important because of the many health benefits associated with low glycemic diets. Along with serving as an assessment tool, the GI checklist can be used as an educational tool to quickly familiarize clients with low GI foods that can be incorporated into their diet. Once educated about the glycemic index, clients can use the GI checklist as a monitoring tool to monitor their progress of incorporating low GI foods into their diet.

In order for the checklist to be used as an assessment, educational and monitoring tool, the instrument had to be validated to guarantee that the GI checklist was able to accurately assess dietary intake. Six of the nutrients represented by foods on the GI checklist were significantly correlated between the Block 2005 FFQ and the GI checklist ($p>.05$). Highly correlated nutrients included: total carbohydrate, total fiber, vitamin c and magnesium. The statistically significant correlations between the GI checklist and the Block 2005 FFQ demonstrated the

ability of the GI checklist to accurately measure nutrient intake, as participant nutrient profiles were similar between the GI checklist and the Block 2005 FFQ.

The GI checklist was developed with the goal of increasing low GI intake in individuals with inadequate low GI consumption. With this goal, it is essential for the GI checklist to accurately identify individuals with an inadequate low GI dietary intake. The GI checklist was determined to be a sensitive dietary assessment tool for identifying individuals with low fruit, dairy and whole grain intake. As a sensitive assessment tool the GI checklist was able to accurately identify individuals with an elevated risk for disease due to their inadequate intake of low glycemic index foods. Since the GI checklist was able to accurately identify individuals with a low GI consumption of fruits, dairy and whole grains, the GI checklist will be a valuable tool for identifying individuals at-risk for disease due to their inadequate low GI dietary intake.

While the GI checklist was a sensitive tool for assessing fruit, dairy and whole grain intake and accurately identified individuals with inadequate low GI dietary intake from fruits, dairy and grains, the GI checklist was unable to identify or specify individuals with a high daily intake of low GI foods. The low specificity of the GI checklist was caused by consistent over-reporting of low GI food consumption on the GI checklist. The consistent over-reporting on the GI checklist may have been a result of several factors. Prior to participation in this study, 94% (n=31) of the 33 participants had received some form of diabetes education, with 55% (n=18) receiving education from a registered dietitian. During these educational sessions it is very likely that the importance of the glycemic index was discussed, making participants aware of its importance. As a result it can be hypothesized that participants over-reported low GI consumption on the GI checklist because they wanted to report 'acceptable' dietary consumption. Along with inaccurate participant reporting, it can also be hypothesized that the over-reporting was due to the design of the study. Participants completed the Block 2005 FFQ, reporting dietary intake over a year, and a single GI checklist, which captured only a single day's dietary intake. In practice clients would be provided several GI checklists to monitor intake over a duration of several days. By providing only a single GI checklist, it is likely that participants reported several days intake on the one GI checklist since they were only provided one GI checklist to complete.

Additional studies must be conducted to further validate the GI checklist and determine its ability to accurately assess nutrient intake. This study required participants to complete one GI checklist to assess a single day's dietary intake. Future studies should provide participants with the Block 2005 FFQ and 4 or 5 GI checklists to assess low GI consumption over a period of several days. Along with extending the dietary assessment period, the GI checklist should be used to assess dietary intake in different populations other than type 2 diabetics. While a high dietary intake of low GI foods has demonstrated beneficial health outcomes in type 2 diabetics (Brand-Miller, Hayne, Petocz, & Colagiuri, 2003), similar diets have also demonstrated beneficial health outcomes in obese individuals (Pal, Lim, & Egger, 2008) and individuals with coronary heart disease (Flight & Clifton, 2006). The strong relationship between high dietary intake of low GI foods and disease prevention and management makes it critical for the GI checklist to be validated in other populations.

References

- Alaimo, K., Olson, CM & Frongillo, EA (1999). Importance of cognitive testing for survey items: An example from food security questionnaires. *Journal of Nutrition Education*, 31, 269-275.
- Block, G., Gillespie, C., Rosenbaum, E., & Jenson, C. (2000). A rapid food screener to assess fat and fruit and vegetable intake. *American Journal of Preventative Medicine*, 18(4), 284.
- Block, G., & Hartman, A. M. (1989). Issues in reproducibility and validity of dietary studies. *American Journal of Clinical Nutrition*, 50(5), 1133.
- Block, G., Hartman, A., & Naughton, D. (1990). A reduced dietary questionnaire: Development and validation. *Epidemiology (Cambridge, Mass.)*, 1(1), 58.
- Brand, J., Colagiuri, S., Crossman, S., Allen, A., Roberts, D., & Truswell, A. (1991). Low-glycemic index foods improve long-term glycemic control in NIDDM. *Diabetes Care*, 14(2), 95.
- Brand-Miller, J., Hayne, S., Petocz, P., & Colagiuri, S. (2003). Low-glycemic index diets in the management of diabetes: A meta-analysis of randomized controlled trials. *Diabetes Care*, 26(8), 2261.
- Carbone, E., Campbell, M., & Honess-Morreale, L. (2002). Use of cognitive interview techniques in the development of nutrition surveys and interactive nutrition messages for low-income populations. *Journal of the American Dietetic Association*, 102(5), 690.

- Drewnowski, A., & Hann, C. (1999). Food preferences and reported frequencies of food consumption as predictors of current diet in young women. *American Journal of Clinical Nutrition*, 70(1), 28.
- Flight, I., & Clifton, P. (2006). Cereal grains and legumes in the prevention of coronary heart disease and stroke: A review of the literature. *European Journal of Clinical Nutrition*, 60(10), 1145.
- Frost, G., Wilding, J., & Beecham, J. (1994). Dietary advice based on the glycaemic index improves dietary profile and metabolic control in type 2 diabetic patients. *Diabetic Medicine : A Journal of the British Diabetic Association*, 11(4), 397.
- Jenkins, D., Wolever, T., Taylor, R., Barker, H., Fielden, H., Baldwin, J., et al. (1981). Glycemic index of foods: A physiological basis for carbohydrate exchange. *American Journal of Clinical Nutrition*, 34(3), 362.
- Jimenez-Cruz, A., Bacardi-Gascon, M., Turnbull, W., Rosales-Garay, P., & Severino-Lugo, I. (2003). A flexible, low-glycemic index mexican-style diet in overweight and obese subjects with type 2 diabetes improves metabolic parameters during a 6-week treatment period. *Diabetes Care*, 26(7), 1967.
- Kristal, A., Abrams, B., Thornquist, M., Disogra, L., Croyle, R., Shattuck, A., et al. (1990). Development and validation of a food use checklist for evaluation of community nutrition Interventions. *American Journal of Public Health*, 80(11), 1318.

- Mullen, B., Krantzler, N., Grivetti, L., Schutz, H., & Meiselman, H. (1984). Validity of a food frequency questionnaire for the determination of individual food intake. *American Journal of Clinical Nutrition*, 39(1), 136.
- Murphy, S., Kaiser, L., Townsend, M., & Allen, L. H. (2001). Evaluation of validity of items for a food behavior checklist. *Journal of the American Dietetic Association*, 101(7), 751.
- Newby, P., Hu, F., Rimm, E., Smith-Warner, S., Feskanich, D., Sampson, L., et al. (2003). Reproducibility and validity of the diet quality index revised as assessed by use of a food-frequency questionnaire. *American Journal of Clinical Nutrition*, 78(5), 941.
- Pal, S., Lim, S., & Egger, G. (2008). The effect of a low glycaemic index breakfast on blood glucose, insulin, lipid profiles, blood pressure, body weight, body composition and satiety in obese and overweight individuals: A pilot study. *Journal of the American College of Nutrition*, 27(3), 387.
- Rizkalla, S., Taghrid, L., Laromiguere, M., Huet, D., Boillot, J., Rigoir, A., et al. (2004). Improved plasma glucose control, whole-body glucose utilization, and lipid profile on a low-glycemic index diet in type 2 diabetic men: A randomized controlled trial. *Diabetes Care*, 27(8), 1866.
- Salmer, Å³n, J., Ascherio, A., Rimm, E., Colditz, G., Spiegelman, D., et al. (1997). Dietary fiber, glycemic load, and risk of NIDDM in men. *Diabetes Care*, 20(4), 545.

Schulze, M., Liu, S., Rimm, E., Manson, J., Willett, W., & Hu, F. (2004). Glycemic index, glycemic load, and dietary fiber intake and incidence of type 2 diabetes in younger and middle-aged women. *American Journal of Clinical Nutrition*, 80(2), 348.

Willis, Gordon B. (1999). Cognitive interviewing: a "how to" guide. *Meeting of the American Statistical Association*.

Wolfe, W., Frongillo, E., & Cassano, P. A. (2001). Evaluating brief measures of fruit and vegetable consumption frequency and variety: Cognition, interpretation, and other measurement issues. *Journal of the American Dietetic Association*, 101(3), 311.

Appendices

Appendix B. Recruitment Flyer

Recruitment flyers were posted at the Ohio State Medical Center and Diabetes Research Center, at various public locations on The Ohio State University campus and at numerous coffee shops and libraries in Columbus, Ohio.

Diabetes?

**Would you like to receive information to help you
manage your diet?**

**Join the glycemic index
checklist study!!**

**Help us develop effective tools to
monitor your diet**



You are eligible if you:

- ✓ are 40-70 years of age
- ✓ have had adult-onset diabetes for at least 1 year

**For more information, please call
(614) 292-4772**

This research study is being conducted by Dr. Carla Miller and has been approved by the Institutional Review Board at The Ohio State University.

Appendix C. Cognitive Interview Questions

Questions asked during the ten cognitive interviews. Each question was followed by additional probing questions based on the participant's response.

1. How difficult was it to recall the previous day's food intake?
2. Would it have been easier to complete the checklist throughout the day as each meal was consumed?
3. What does the term glycemic index mean to you?
4. Have you had any previous knowledge or exposure to the glycemic index?
5. What do the ½, ½, 1, 1 boxes mean to you?
6. What would you consider a low glycemic index food that could be added into the appropriate box?
7. Were any foods or categories on the checklist unclear?
8. Were there any foods consumed over the past two days that you would consider a low glycemic index foods that was not included on the checklist?

Appendix D. Demographic Questionnaire

Completed by participants involved in study #1 (modification) and study #2 (validation).
Responses were documented using Microsoft Office 2007 Excel database.

ID No. _____

General Information Questionnaire

We would like to ask you a few questions about your diabetes care to help us understand the results of this study. You do not have to answer any questions you do not wish to answer, but your answers are important for our research. So, we ask that you answer as many as possible. All your answers will be kept completely confidential. Thank you!

Section A

1. In general, would you say your health is:
☐ Excellent
☐ Very good
☐ Good
☐ Fair
☐ Poor
2. Do you test your blood sugar at home?
☐ No (please skip to question 6)
☐ Yes (please continue with question 3)
3. How many days a week do you test your blood sugar?
☐ 0-1 days/week
☐ 2-3 days/week
☐ 4-5 days/week
☐ 6-7 days/week
4. On the days that you test, how many times per day do you test your blood sugar?
☐ 1-2 times/day
☐ 3-4 times/day
☐ 5-6 times/day
☐ >6 times/day
5. Do you keep a record of your blood sugar test results?
☐ No
☐ Yes
☐ Only unusual values

6. How often do you follow a meal plan or diet?

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Usually
- ☐ Always

7. Which methods have you used to control your blood glucose? Please check all that apply.

- ☐ Exchange Lists
- ☐ Carbohydrate Counting
- ☐ Glycemic Index
- ☐ Smaller Portions
- ☐ Routine meal plan
- ☐ Popular or fad diets (please list _____)
- ☐ Exercise
- ☐ Other (please describe _____)

8. When was the last time you had a hemoglobin A1c test? Please enter the month and year. _____(month) _____(year)

9. What was the value of your hemoglobin A1c test? Please enter the number.

10. Have you ever received diabetes education?

- ☐ No (please skip to question 12)
- ☐ Yes
- ☐ Not Sure

11. Please check all of the sources where you received instruction in diabetes from the options below.

- ☐ Physician in physician's office
- ☐ Nurse in physician's office
- ☐ Dietitian or nutritionist
- ☐ Physician or nurse in a hospital
- ☐ Diabetes education class
- ☐ Diabetes support group
- ☐ Health department
- ☐ Other, please describe _____

12. How many times have you seen a dietitian about a meal plan or diet?

- ☐ 1-2 times
- ☐ 3-5 times

☐ More than 5 times

13. My last visit with a dietitian was: (please check one)

- ☐ Within the last 12 months
- ☐ 1-2 years ago
- ☐ 2-3 years ago
- ☐ More than 3 years ago
- ☐ Never had a visit with a dietitian

14. Have you been told to weigh or measure your food?

- ☐ No
- ☐ Yes
- ☐ Not sure

15. Have you been told to use exchange lists or food group lists to plan your meals?

- ☐ No
- ☐ Yes
- ☐ Not sure

16. Have you been told to use carbohydrate counting to plan your meals?

- ☐ No
- ☐ Yes
- ☐ Not sure

Section B

Now we would like to ask you some general questions about yourself to help us interpret the findings.

1. Year of birth? 19____

2. What is your gender?

- ☐ Male
- ☐ Female

3. Please check your education level.

- ☐ Less than 12th grade
- ☐ High school diploma or GED
- ☐ Vocational/Trade school
- ☐ Some college
- ☐ Bachelor's degree
- ☐ Advanced degree (M.S., Ph.D., M.D.)

4. Are you employed on a full- or part-time basis? Please check one.
- ☐ Full-time (32 hours or more per week)
 - ☐ Part-time (less than 32 hours per week)
 - ☐ Full-time homemaker
 - ☐ Full-time student
 - ☐ Retired
 - ☐ Disabled, not able to work
5. What is your marital status? Please check one.
- ☐ Never married
 - ☐ Married
 - ☐ Separated/divorced
 - ☐ Widowed
6. How many people live with you? Please check one.
- ☐ I live alone
 - ☐ 1 person
 - ☐ 2 people
 - ☐ 3 people
 - ☐ 4 people
 - ☐ 5 or more people
7. What is your ethnic origin/race? Please check one.
- ☐ White
 - ☐ Black or African American
 - ☐ Asian American
 - ☐ American Indian or Alaska Native
 - ☐ Native Hawaiian or Other Pacific Islander
 - ☐ Hispanic or Latino American
 - ☐ Other (please specify _____)
8. How would you describe the insurance plan you have had in the past 12 months? Please check all that apply.
- ☐ An individual plan – the member pays for the plan premium
 - ☐ A group plan through an employer – the employer pays all or part of the plan premium
 - ☐ U.S. governmental health plan
 - ☐ Student insurance plan
 - ☐ Medicaid
 - ☐ Medicare
 - ☐ I have not had an insurance plan in the past 12 months

9. How tall are you? _____Feet _____Inches

10. How much do you currently weigh? _____pounds

11. Which of the following best describes your household income in 2007?

- _____ Less than \$10,000
- _____ \$10,000 to \$19,999
- _____ \$20,000 to \$29,999
- _____ \$30,000 to \$39,999
- _____ \$40,000 to \$49,999
- _____ \$50,000 to \$59,999
- _____ \$60,000 or more

